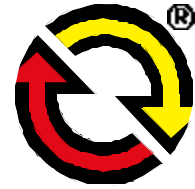


DETROIT DIESEL

CORPORATION



April 20, 2000

Chief, Environmental Enforcement Section
Environmental and Natural Resource Division
US Department of Justice
Room 13063
1425 New York Avenue NW
Washington, D.C. 20005

Director, Air Enforcement Division (2242A)
US Environmental Protection Agency
Room 1117
South Lobby
Ariel Rios Building
1200 Pennsylvania Avenue NW
Washington, D.C. 20044

Executive Officer
Air Resources Board
2020 L Street
Sacramento, CA 95814

RE: Scope of Work Submittal; Company Proposed Projects – Metropolitan Atlanta
Clean Natural Gas Transit Bus Heavy Duty Engine Deployment Program and
Appendix E Project – Supplemental NOx Emission Offset Project

To Whom It May Concern:

Detroit Diesel Corporation hereby submits the following Scope of Work (SOW), characterized as Company Proposed Projects in accordance with Paragraphs 85 and 91 of the Consent Decree filed in United States v. Detroit Diesel Corporation (Civil Action No. 98-2548) and the settlement agreement between Detroit Diesel Corporation (DDC) and the California Air Resources Board (ARB). (References herein to the “Consent Decree” are also meant to refer to the parallel provisions of DDC’s settlement agreement with the ARB.)

Paragraph 85(b) states that 25% of the Net Project Funds shall be spent on projects to be proposed by DDC consistent with the criteria set forth in Paragraph 89, after giving due consideration to projects submitted by third parties during the public comment period under Paragraph 149 of this Consent Decree (the “Company Proposed Projects”).

Per DDC's Company Proposed Project Submittal, dated January 21, 2000, DDC has elected to perform five projects that meet the requirements stated above and will spend a total of \$1,750,000 to successfully complete these projects. This financial obligation is also consistent with the requirement for Additional Projects Following Public Comment under Appendix E of the Consent Decree. Two of these projects resulted from the public submittals, and three projects were borne out of DDC. In addition to the Company Proposed Projects, DDC submitted Appendix E Projects in a letter dated January 21, 2000. Included in Appendix E projects is a project entitled "Supplemental NOx Emissions Offset Project". This SOW includes this project as a supplement to the public submittal derived Company Proposed Project "Metropolitan Atlanta Clean Natural Gas Transit Bus Heavy Duty Deployment Program".

The selection of Company Proposed Projects was conducted in accordance with the provisions outlined in paragraph 85 (b), whereby DDC gave due consideration to projects submitted by third parties in conjunction with Paragraph 149 of the Consent Decree. On October 19, 1999 DDC provided a full listing of eighty-three publicly submitted projects and discussed the process for reviewing the proposals. Upon DDC's thorough review, the projects were narrowed down to ten. These ten candidate projects, along with an overview of DDC's project selection process, were presented to and discussed with the EPA. DDC plans to complete two projects that resulted from these publicly submitted proposals.

DDC submits this SOW based on our previous experience in supporting our customers needs and believes it satisfies the requirements of the Consent Decree and Settlement Agreement. If you have questions regarding our plan, please feel free to contact DDC .

In accordance with Paragraph 94, DDC certifies that, as of the date of this submittal, DDC is not required by any federal, state, or local law to perform or develop any of the projects it proposes to implement or perform, nor is DDC required to perform or develop the projects by any agreement, other than this Consent Decree, by grant, or as injunctive relief in any other case. Except as set forth in Paragraph 85, DDC further certifies that it has not received, and is not presently negotiating to receive, and will not seek credit for the projects in any other environmental enforcement proceeding.

To the best of my knowledge after thorough investigation, I certify that the information contained in or accompanying this submission is true and accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fines and imprisonment for knowing violations.

Timothy S. Tindall
Director, Emission Programs

SCOPE OF WORK

METROPOLITAN ATLANTA CLEAN NATURAL GAS TRANSIT BUS HEAVY-DUTY ENGINE DEPLOYMENT PROGRAM AND SUPPLEMENTAL NO_x EMISSION OFFSET PROJECT

Introduction

Upon review with EPA of eighty-three projects submitted by third parties in conjunction with Paragraph 149 of the Consent Decree, DDC selected two proposals, one of which is to provide Compressed Natural Gas (CNG) engines at a discounted price to Metropolitan Atlanta Rapid Transit Authority (MARTA) for use in their transit buses. It is believed that this Company Proposed project, in addition to CNG engines subsidized by the Supplemental NO_x Emission Offset Project, allows the transit authority to place into service more CNG powered vehicles earlier than would be otherwise possible. This will result in near-term air quality improvements in metropolitan Atlanta which is classified as a serious ozone non-attainment area per MARTA's submittal. DDC funding of these projects includes towards the purchase of CNG engines, and an additional applied to incremental costs of Series 50 CNG engines above Series 50 diesel engines.

Emissions Benefits

The Series 50 CNG engine offers significant emissions benefits compared to the diesel powered buses being decommissioned from the fleet. Based on calculations (see Attachment 1) which assume a 12-year life, it is estimated that NO_x reductions of 15.6 tons per vehicle may be achieved. In addition, particulate emission reductions of an order of magnitude compared to older conventional bus engines can be anticipated. Smoke emissions from CNG powered buses are negligible, far below the visible threshold.

Implementation

Deployment of 184 Series 50 CNG powered buses in the MARTA fleet is anticipated to occur in two phases. The first phase will begin in the third quarter of calendar year 2000, and the second phase in the second quarter of 2001. All units will be commissioned into service before the end of 2001.

DDC submits this Scope of Work based on our previous experience in supporting our customers needs and believes it satisfies the requirements of the Consent Decree and Settlement Agreement. If you have questions regarding our SOW please feel free to contact

Attachment 1 CALCULATION OF NO_x REDUCTION – MARTA SERIES 50
CNG PROJECT

The basic equation is derived from the EPA's formula used to calculate excess NO_x. Shown is the EPA's basic equation, calculating for grams of NO_x. The following basic equation was developed by the EPA and provided to DDC.



NO_x Benefit Per Bus

OR **15.6 tons per bus**

DETROIT DIESEL

CORPORATION



April 20, 2000

Chief, Environmental Enforcement Section
Environmental and Natural Resource Division
US Department of Justice
Room 13063
1425 New York Avenue NW
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Director, Air Enforcement Division (2242A)
US Environmental Protection Agency
Room 1117
South Lobby
Ariel Rios Building
1200 Pennsylvania Avenue NW
Washington, D.C. 20044

Executive Officer
Air Resources Board
2020 L Street
Sacramento, CA 95814

RE: Scope of Work Submittal; Company Proposed Projects – Incremental Cost Funding
of CNG Buses for the Port Authority of Allegheny County

To Whom It May Concern:

Detroit Diesel Corporation hereby submits the following Scope of Work (SOW), characterized as Company Proposed Projects in accordance with Paragraphs 85 and 91 of the Consent Decree filed in United States v. Detroit Diesel Corporation (Civil Action No. 98-2548) and the settlement agreement between Detroit Diesel Corporation (DDC) and the California Air Resources Board (ARB). (References herein to the “Consent Decree” are also meant to refer to the parallel provisions of DDC’s settlement agreement with the ARB.)

Paragraph 85(b) states that 25% of the Net Project Funds shall be spent on projects to be proposed by DDC consistent with the criteria set forth in Paragraph 89, after giving due consideration to projects submitted by third parties during the public comment period under Paragraph 149 of this Consent Decree (the “Company Proposed Projects”).

Per DDC's Company Proposed Project Submittal, dated January 21, 2000, DDC has elected to perform five projects that meet the requirements stated above and will spend a total of \$1,750,000 to successfully complete these projects. This financial obligation is also consistent with the requirement for Additional Projects Following Public Comment under Appendix E of the Consent Decree. Two of these projects resulted from the public submittals, while the remaining three projects were borne out of DDC. This SOW describes the public submittal derived Company Proposed Project "Incremental Cost Funding of CNG Buses for the Port Authority of Allegheny County". DDC will provide funding for this project.

The selection of its Company Proposed Projects was conducted in accordance with the provisions outlined in paragraph 85 (b), whereby DDC gave due consideration to projects submitted by third parties in conjunction with Paragraph 149 of the Consent Decree. On October 19, 1999 DDC provided a full listing of eighty-three publicly submitted projects and discussed the process for reviewing the proposals. Upon DDC's thorough review, the projects were narrowed down to ten. These ten candidate projects, along with an overview of DDC's project selection process, were presented to and discussed with the EPA. DDC plans to complete two projects that resulted from these publicly submitted proposals.

DDC submits this SOW based on our previous experience in supporting our customers needs and believes it satisfies the requirements of the Consent Decree and Settlement Agreement. If you have questions regarding our plan, please feel free to contact DDC .

In accordance with Paragraph 94, DDC certifies that, as of the date of this submittal, DDC is not required by any federal, state, or local law to perform or develop any of the projects it proposes to implement or perform, not is DDC required to perform or develop the projects by any agreement, other than this Consent Decree, by grant, or as injunctive relief in any other case. Except as set forth in Paragraph 85, DDC further certifies that it has not received, and is not presently negotiating to receive, and will not seek credit for the projects in any other environmental enforcement proceeding.

To the best of my knowledge after thorough investigation, I certify that the information contained in or accompanying this submission is true and accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fines and imprisonment for knowing violations.

Timothy S. Tindall
Director, Emission Programs

SCOPE OF WORK

INCREMENTAL COST FUNDING OF CNG BUSES FOR THE PORT AUTHORITY OF ALLEGHENY COUNTY

Introduction

Upon review with EPA of eighty-three projects submitted by third parties in conjunction with Paragraph 149 of the Consent Decree, DDC selected two proposals. One of these proposals involves DDC contributing towards deployment of compressed natural gas (CNG) powered buses in the Port Authority of Allegheny County fleet, specifically in the Pittsburgh region. The Pittsburgh region is classified as a moderate ozone non-attainment area. The emissions benefits of CNG engines are well documented. Upon procurement and commissioning of CNG powered buses into service, a positive impact on the environment will be realized immediately.

Emissions Benefits

The Series 50 Natural Gas engine offers significant emissions benefits compared to the diesel powered buses being decommissioned from the fleet. Based on calculations (see Attachment 1) which assume a 12-year life, it is estimated that NOx reductions of 15.6 tons per vehicle may be achieved. In addition, particulate emission reductions of an order of magnitude compared to older conventional bus engines can be anticipated. Smoke emissions from Natural Gas powered buses are negligible, far below the visible threshold.

Implementation

. The anticipated sequence of events is described as follows. In the second quarter of 2000, the Port Authority and DDC will develop the final details of their commercial agreement, with bus specifications defined by late third quarter 2000. The following procurement award is targeted for the fourth quarter 2000. Reflecting typical lead-times for commercial bus builds, customer approval, preparation and commissioning into service, the CNG buses are anticipated to begin service mileage accumulation no sooner than Fall 2001.

DDC will report on progress towards achieving the above milestones on a quarterly basis. The funding is, as described in our January 21, 2000 project proposal letter, directed towards incremental cost of CNG powered buses over diesel powered buses. Acknowledging EPA's January 21, 2000 response to the above-mentioned letter, DDC is committed, in our discussions with the property, to applying the funding in the most effective manner towards maximizing the implementation of CNG engines and

therefore, NO_x benefit.

DDC submits this Scope of Work based on our previous experience in supporting our customers needs and believes it satisfies the requirements of the Consent Decree and Settlement Agreement. If you have questions regarding our SOW please feel free to contact

Attachment 1**CALCULATION OF NO_x REDUCTION – PORT
AUTHORITY SERIES 50 CNG PROJECT**

The basic equation is derived from the EPA's formula used to calculate excess NO_x. Shown is the EPA's basic equation, calculating for grams of NO_x. The following basic equation was developed by the EPA and provided to DDC.



NO_x Benefit Per Bus

OR **15.6 tons per bus**

COMPANY PROPOSED PROJECT

Fleet Demonstration of Advanced Integrated Engine-Catalyst Systems

Introduction

Detroit Diesel Corporation (DDC) has allocated _____ to conduct a fleet evaluation of advanced integrated engine-catalyst systems. These demonstrations will be the result of a parallel advanced research and development project which will produce advanced-concepts integrated systems with target emissions levels below 1.5 g/hp-hr NOx _____.

Real-world operating conditions _____ will be considered _____. The appropriate diesel fuel, which is compatible with the aftertreatment technology, will be used in this demonstration.

Emissions Benefits

It is anticipated that initial NOx emissions benefits to the environment will be _____

_____ Due to the advanced nature of the integrated prototype hardware and expected high level of controls' sophistication, the demonstration vehicles are likely to be chosen from recent model releases. Field demonstration will last approximately three years.

Implementation

DDC will coordinate and manage the conversion of three Class 8 trucks _____ to the new advanced prototype demonstration hardware. DDC will be providing labor and material to support the _____ conversions, within the limitations of this project. _____ Once converted, vehicles will be road tested over a few days to verify functionality and resolve any operational concerns prior to delivery to the customer.

Engine and Vehicle Conversions

The conversions for both engine and vehicle will be undertaken to accommodate necessary components for the advanced prototype integrated engine aftertreatment concepts. Auxiliary tanks for supplemental fluids may be needed and installed. Other necessary vehicle installations will be accommodated.

Duration and Engineering Support

DDC anticipates that the fleet demonstration will last approximately three years _____ as long as the advanced prototype hardware is satisfactorily performing in the field. DDC will provide necessary support by factory engineering personnel for the pilot conversion. DDC will also provide training regarding operation, maintenance and troubleshooting of the advanced prototype system.

Appendix E – Advanced Research and Development Programs – Project Definition

(1) Integrated Engine-Catalyst System Strategies For Reduced NOx and Particulates

SCOPE OF WORK

Program Goals

This project is to achieve reduced emissions levels matching or surpassing the criteria outlined in Appendix E – NOx Levels at or below 1.5 g/hp-hr. While it is not the main goal of this program, aggressive reduction of PM will be pursued.

Introduction

This program will focus on an integrated (total) engine-aftertreatment system approach for emissions reductions of the heavy duty diesel engine (HDDE). Much attention has been paid to the development of the engine for reducing engine-out exhaust emissions, and also to the aftertreatment devices for maximizing post-engine emissions reduction. However, an integrated approach will lead to a global minimum in emissions while minimizing the penalties imposed on other relevant factors such as fuel economy, durability and life cycle cost.

PHASE I

Task 1 – HDDE Aftertreatment Technologies Screening And Down-Selection

Specifically, the program will start by evaluating and ranking of currently emerging as well as promising advanced exhaust aftertreatment technologies. A partial list of these technologies include:

- Active lean NOx catalysts
- NOx adsorbers
- Selective catalytic reductant (SCR) systems
- Plasma assisted catalyst systems
- Continuously regenerative particulate filters/traps
- Integrated SCR-particulate aftertreatment devices
- Fuel borne catalysts

An exhaustive state-of-the-art review will include ranking of these aftertreatment systems with respect to the HDDE applications.

Another facet of this task is examination of engine exhaust stream influential factors in terms of physical and chemical properties. For example, a well-known influential

parameter in particulate catalysis is the availability of the NO_x in the exhaust stream, since NO₂ is needed to oxidize soot. Engine-out NO_x reduction will result in reduced NO₂ availability for particulate conversion. Thus, a combined system for both particulate and NO_x reduction may be less efficient in PM conversion if the proper NO_x/PM ratio is not attained. The results of this task will be a ranking of the aftertreatment technologies and preliminary definition of the various operating conditions.

Task 2 – Simulation and Modeling

A simulation effort will be initiated. Baseline engine models will be integrated into a single platform with currently available aftertreatment analytical models. An essential element of optimizing the integrated engine-catalyst system is the ability to run advanced control strategies in the virtual lab thus providing earlier results than would be only attainable with expensive (if available) hardware and longer lead times. Additionally, the details available from the simulation should be more extensive than those obtained experimentally. The expected output of this effort will be establishing a virtual lab baseline system. This suite of simulation models will provide a springboard for future analysis and optimization. An additional output will be a preliminary definition of promising system(s) for further investigation during the remainder of the program tasks.

Task 3 – Preliminary Experimental Testing

An early detailed experimental speciation of the engine-out exhaust stream will provide validation for the baseline models. Relevant physical, chemical and thermodynamic state properties will be measured.

Task 4 – Emissions Reduction Sensors

Detroit Diesel will investigate advanced exhaust stream sensors. The viability of incorporating sensors in the control-loop of the integrated system can have positive impact on the outcome of this program.

Phase I Results

The conclusion of the “general” screening phase will be examined. The detailed roadmap for Phase II will be updated and used as a guideline for the remainder of the project.

PHASE II

Task 5 – System Design and Analysis

A thorough detailed design and analysis of the selected prime path will be undertaken. This task will produce a specification for the integrated system.

Task 6 – Final System Procurement, Verification and Refinements

A lab verification phase would follow where the integrated hardware would be tested in a designed experiment. In parallel, virtual lab simulations will be validated and exercised for final refinement of the system.

Task 7 – Initial Field Demonstration

Anticipated success of this program will lead to procurement and an on-vehicle system demonstration test.

Task 8 – Iterative System Upgrade, Testing and Demonstration

Continuous system upgrades/optimizations will be undertaken based on field results and lab tests. It is anticipated that prototype systems upgrade will be tested as warranted on-board vehicle systems and will feed into expanded field demonstration under the DDC Company-Proposed projects as submitted.

April 24, 2000

Chief, Environmental Enforcement Section
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Director, Air Enforcement Division (2242A)
US Environmental Protection Agency
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South Lobby
Ariel Rios Building
1200 Pennsylvania Avenue NW
Washington, D.C. 20044

Executive Officer
Air Resources Board
2020 L Street
Sacramento, CA 95814

RE: Scope of Work Submittal – Company Proposed Project – Fleet
Demonstration of Continuously Regenerative Diesel Particulate Filters

To Whom It May Concern:

Detroit Diesel Corporation hereby submits the following Scope of Work (SOW), characterized as a Company Proposed Project in accordance with Paragraphs 85 and 91 of the Consent Decree filed in United States v. Detroit Diesel Corporation (Civil Action No. 98-2548) and the settlement agreement between Detroit Diesel Corporation (DDC) and the California Air Resources Board (ARB). (References herein to the “Consent Decree” are also meant to refer to the parallel provisions of DDC’s settlement agreement with the ARB.)

Paragraph 85(b) states that 25% of the Net Project Funds shall be spent on projects to be proposed by DDC consistent with the criteria set forth in Paragraph 89, after giving due consideration to projects submitted by third parties during the public comment period under Paragraph 149 of this Consent Decree (the “Company Proposed Projects”).

Per DDC's Company Proposed Project Submittal, dated January 21, 2000, DDC has selected five projects which meet the requirements stated above and will spend a total of \$1,750,000 to successfully complete these proposed projects. This financial obligation is also consistent with the requirement for Additional Projects Following Public Comment under Appendix E of the Consent Decree. Two of the five projects resulted from the public submittals, and three projects were borne of DDC. This SOW provides a description of the DDC borne project "Fleet Demonstration of Continuously Regenerative Diesel Particulate Filters", for which DDC is providing funding. DDC notes that that this project will employ additional funds from other sources.

DDC submits this Scope of Work based on our previous experience in supporting our customers needs and believes it satisfies the requirements of the Consent Decree and Settlement Agreement. If you have questions regarding our SOW please feel free to contact
DDC .

In accordance with Paragraph 94 of the Consent Decree, DDC certifies that, as of the date of this submittal, DDC is not required by any federal, state, or local law to perform or develop any of the projects it proposes to implement or perform, nor is DDC required to perform or develop the projects by any agreement, other than the Consent Decree, by grant, or as injunctive relief in any other case. Except as set forth in Paragraph 85 of the Consent Decree, DDC further certifies that it has not received, and is not presently negotiating to receive, and will not seek credit for the projects in any other environmental enforcement proceeding.

To the best of my knowledge after thorough investigation, I certify that the information contained in or accompanying this submission is true and accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fines and imprisonment for knowing violations.

Timothy S. Tindall
Director, Emission Programs

SCOPE OF WORK

FLEET DEMONSTRATION OF CONTINUOUSLY REGENERATIVE DIESEL PARTICULATE FILTERS

Introduction

DDC will allocate towards implementation and evaluation of the impact of low sulfur fuel coupled with continuously regenerative diesel particulate filters over a one-year operating period. DDC will participate in the management of demonstration fleets that involve approximately 60 vehicles operating on fuels including near-zero sulfur diesel fuel. In combination with the near-zero sulfur diesel fuel, selected vehicles will be retrofitted with diesel particulate filters. The test vehicle fleets will operate in the Los Angeles region of Southern California, based on availability of near-zero sulfur fuel.

Emission measurements from selected vehicles from each demonstration fleet will be collected at the start of the demonstration and upon completion. The baseline emissions measurements will include operation on standard California specification fuel, near-zero sulfur fuel, and with diesel particulate filters in conjunction with near-zero sulfur fuel. Fleet vehicles participating in the project include both on-highway line-haul trucks and urban transit buses. The in-use emission evaluation will include measurements of NO_x, HC, CO and PM. Emission testing will be conducted by a contracted third party and will utilize a chassis dynamometer that includes laboratory grade emission analyzers. Particulate matter speciation and toxicity studies will be included on at least two of the vehicles. This project was launched in the fourth quarter of 1999 with emissions testing expected to span a period of 12 months.

This fleet demonstration carries several unique benefits. The primary objective of this project is to illustrate the capabilities of catalytic diesel particulate filters as a potentially viable future emission control technology. Also, successful demonstration of aggressive particulate emission reductions may enable certain NO_x reduction strategies. Additionally, this project may lead to an emission reduction solution for older engines in the form of an aftertreatment retrofit.

The diesel particulate aftertreatment project fulfills all the priorities and criteria as outlined in Paragraph 89 of the Consent Decree. DDC notes that this project will employ additional funds from other sources.

Emissions Benefits

Multiple emissions benefits are anticipated from this project, with the primary focus being the demonstration of post-combustion particulate matter (PM) emissions reduction technology. Additional emissions benefits of the technology planned for demonstration is the catalytic oxidation of HC and CO emissions. Effects on NO_x emissions of the fuel and PM aftertreatment are anticipated to be negligible.

Attachment 1 provides a calculated estimate of anticipated PM emissions reduction of 0.50 Tons based on a one year operation of three PM aftertreatment equipped vehicle fleets, namely a fleet of ten Class 8 grocery delivery trucks, and two Transit Bus Fleets of ten units each. A PM filtering efficiency of 80% is assumed. Reduction of CO and HC emissions are anticipated to be over 80%. Additional benefits beyond the first year of operation will be derived as a function of the individual fleet's strategy regarding continuation of the demonstration project.

Implementation

Three primary fleets included in the demonstration program will have the largest impact on emissions reductions. These are, Ralphs Grocery Company, Santa Monica Transit and Los Angeles County Mass Transit Association. Ten Ralphs Grocery Series 60 powered trucks completed installation of PM filters at DDC's local distributor and were converted to near-zero fuel operation in the first quarter of 2000. Units, now in operation, will be monitored through the course of the demonstration. Ten Santa Monica Transit Series 50 diesel powered transit buses are scheduled for conversion to near-zero sulfur fuel and PM filter installation by mid-2000. Final details of Santa Monica Transit's and LAMTA's plans to convert their fueling facility and establish fueling logistics to accommodate near-zero sulfur fuel are in process.

Impact of fuel and aftertreatment will be measured using a transportable emissions laboratory developed by West Virginia University (WVU). The transportable emissions lab consists of a heavy-duty transient chassis dynamometer and an emissions measurement laboratory. The WVU transportable emissions laboratory design and test procedures have been periodically peer-reviewed by industry experts, and has shown good correlation with the Colorado School of Mines CIPHER chassis dynamometer laboratory on tests run with both diesel and natural gas transit buses.

Chassis dynamometer test cycles for emissions measurements have been selected to be representative of the vehicle applications. The Class 8 trucks will be tested on a City-Suburban Heavy Vehicle Route (CSHVR) developed by WVU to represent typical non-rural application, while the transit buses will be tested on the Central Business District (CBD) cycle. The CBD cycle is an industry recognized cycle which represents they highly transient stop-and-go nature of typical inner-city bus operation.

DDC submits this Scope of Work based on our previous experience in supporting our customers needs and believes it satisfies the requirements of the Consent Decree and Settlement Agreement. If you have questions regarding our SOW please feel free to contact

DDC

In accordance with Paragraph 94 of the Consent Decree, DDC certifies that, as of the date of this submittal, DDC is not required by any federal, state, or local law to perform or develop any of the projects it proposes to implement or perform, nor is DDC required to perform or develop the projects by any agreement, other than the Consent

Decree, by grant, or as injunctive relief in any other case. Except as set forth in Paragraph 85 of the Consent Decree, DDC further certifies that it has not received, and is not presently negotiating to receive, and will not seek credit for the projects in any other environmental enforcement proceeding.

**Attachment 1 EMISSIONS BENEFITS – FLEET DEMONSTRATION OF
CONTINUOUSLY REGENERATIVE DIESEL PARTICULATE
FILTERS**

PARTICULATE EMISSIONS

The basic equation is derived from the EPA's formula

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PM Tonnage Reduction = 0.15 Tons

Appendix E – Advanced Research and Development Programs – Project Definition

(2) Model-Based (Smart) Engine for Practical Emissions Reduction

SCOPE OF WORK

Program Goals

This program aims at the development and demonstration of an advanced model-based controlled heavy duty diesel engine (HDDE) targeted to operate at emissions level at or below 1.5 g/hp-hr NO_x. No advanced NO_x or PM aftertreatment technologies are planned to be incorporated in the proposed program. As such, the 1.5 g/hp-hr NO_x value is considered a stretch target.

Introduction

This advanced research and technology development project will focus on the development of an integrated model-based approach to control engine operations for emissions reduction of the HDDE. Current state-of-the-art production engine controls have many limitations. The model-based controls (MBC) approach will offer the premise to address current system shortcomings, thereby achieving better tradeoffs between engine emissions, performance, fuel economy, thermal loading, durability, and life-cycle-cost factors in general.

PHASE I

Task 1 – MBC Approaches Screening and Down-Selection

This program focuses on maximizing the engine-out emissions reduction through the use of an advanced multi-variable robust control of the core engine subsystems. Review of the state-of-the-art in modern control theory reveals the need to target and select certain approaches for predictive linear and nonlinear controls of multi-input multi-output (MIMO) systems. The application to the HDDE engine as the "power plant" will warrant focused attention.

The control methods to be investigated include:

- Predictive control
- Adaptive control
- Neural network
- Artificial intelligence
- Fuzzy logic
- Nonlinear multivariable control

Current state-of-the-art engine control will be used as a benchmark. The result from Task 1 will be a ranking of all investigated control methods.

Task 2 – Engine Modeling

Models will include the following features of engine operation:

- Fuel injection system
- Combustion
- Heat rejection
- Variable geometry turbocharger
- Exhaust gas recirculation

The expected output will be a baseline virtual set of engine controls integrated suite.

Task 3 – Controls Modeling

Control approaches selected in Task 1 will be modeled. The control model will be linked to the engine model. This combination will be used for further comparison of modern control approaches.

Task 4 – Rapid Controls Prototyping

DDC will use rapid prototyping hardware and software to control engine subsystems. This arrangement will be followed by testing a running engine.

Limited engine testing using the available most advanced DDC engine hardware and controls tools will be part of this task, focusing on comparing new control methods with the baseline.

Phase I Results

Phase I will result in the establishment of a validated virtual lab tool set. The most viable MBC approaches will be identified. Investigation in the virtual lab and testing in the experimental lab through rapid controls prototyping will weed out the less viable MBC options.

PHASE II

Task 5 – Phase II Planning

Based on the results of Phase I, DDC will review the Phase II plan and adjust it as necessary.

Task 6 – Nonlinear Controls

It is expected that the most novel control methods selected in Phase I will deal with inherent nonlinearity of engine systems. While these approaches are to resolve stability, they will not be robust. DDC will additionally investigate the application of emerging advanced methodologies

Task 7 – Virtual Sensors

Depending on the selection of the control approach, new advanced virtual sensors may be required. DDC will investigate the state-of-the-art measuring techniques and will seek advanced, novel virtual sensing methodologies.

Task 8 – On-Board Diagnostics (OBD)

A model-based control offers a bridge to initial work for on-board diagnostics. This exploratory effort should be useful for future OBD efforts.

Task 9 – Iterative Upgrades and Testing

The area of model-based controls is developing fast, with many commercial, academic institutions and National Laboratories looking for ways to apply the emerging theories to HDDE's. DDC expects that new developments between now and 2003 will open the door for even more advanced approaches to be investigated as potentially viable for the HDDE.

Program Funding

DDC intends to invest into this Model-Based (Smart) Engine program.

FLEET DEMONSTRATION OF UREA-BASED CATALYTIC REDUCTANT TECHNOLOGY

Detroit Diesel Corporation (DDC) has allocated \$1.5 million towards vehicle fleet evaluation of a urea-based aftertreatment technology targeted towards the reduction of gaseous NOx emissions to levels less than 1.5 g/hp-hr. This effort is part of a larger collaborative program with Freightliner (FTL), Los Angeles Valley Material Transportation (VMT), and California State and Local Authorities.

Emissions Benefits

Implementation

Implementation efforts have already been initiated based on project approval and the timetables established.

Vehicle Installation

Design and installation of an SCR system for the FTL application has been completed.

Baseline and Future Testing

Following installation and initial shakedown at FTL in Portland, Oregon, the SCR system will be evaluated on-road using the EPA Emission Trailer. This will result in baseline on-highway emissions performance for the “fresh” systems. Follow-up tests will be conducted to track emissions at future intervals during the three-year program. The feedback from this work will be used to improve catalyst formulations and refine the system design.

In-Use Plan and Training

Approximately eight trucks will be fitted with systems. VMT has agreed to operate their normal, commercial routes with these FLT trucks. The results will be a “real-world” system evaluation.

Urea supply provisions have been made at the VMT service facility in Southern California. Operator training will be carried out to ensure that procedures are understood and put in place to ensure consistent and correct operations.

DDC Engineering Support

DDC will monitor and support the program throughout the three-year vehicle fleet evaluation period. Fast deployment of field support personnel will be provided as warranted.

Continued emissions reduction effectiveness, operator comments, infrastructure issues and operating costs will be monitored and studied. The first year of field operation will be the most intense period of evaluation with follow-up planned for the second and third years as required.

Reporting

A final report will be issued at the conclusion of the program with specific recommendations regarding feasibility and areas that need to be addressed to improve further emissions reductions.

July 24, 2000

Chief, Environmental Enforcement Section
Environmental and Natural Resource Division
US Department of Justice
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1425 New York Avenue NW
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Washington, D.C. 20044

Executive Officer
Air Resources Board
2020 L Street
Sacramento, CA 95814

RE: Revised Scope of Work – California Offset Project

To Whom It May Concern:

Detroit Diesel Corporation hereby submits this revision to the Scope of Work (SOW), characterized as California Offset Projects originally submitted in accordance with Paragraph 91 of the Consent Decree filed in United States v. Detroit Diesel Corporation (Civil Action No. 98-2548) and the settlement agreement between Detroit Diesel Corporation (“DDC”) and the California Air Resources (“ARB”). (References herein to the “Consent Decree” are also meant to refer to the parallel provisions of DDC’s settlement agreement with the ARB.) Included in this submittal are revisions to the original SOW that expand upon DDC’s June 5, 2000 response (see SOW Attachment 2) to questions raised in ARB’s May 25, 2000 response to the originally SOW submitted on April 10, 2000. In addition, a change in grocery companies participating in this project is included

Paragraph 85, sub-part (a) states that 20% of the Net Project Funds, \$1,400,000, shall be spent on the projects agreed to in, or selected pursuant to, the California Settlement Agreement with respect to DDC’s California Pre-Settlement and Interim Engines. DDC’s satisfaction of its obligations under the California Settlement Agreement with

respect to this 20% of the Net Project Funds shall fully satisfy its obligation to the United States under this Consent Decree with respect to such amount.

If you have questions regarding our plan please feel free to
DDC .

To the best of my knowledge after thorough investigation, I certify that the information contained in or accompanying this submission is true and accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fines and imprisonment for knowing violations.

Timothy S. Tindall
Director, Emission Programs

Attachments

SCOPE OF WORK

Introduction

This Project Scope of Work meets the requirements of Appendix J of the California Settlement Agreement by providing the re-power of Class 8 diesel fuel trucks to operate on natural gas fuel. Natural Gas technology offers significant reductions in NOx and particulate emissions compared to current diesel engine technology. DDC has successfully solicited the participation of two major grocery fleets, and in this project. The grocery delivery vehicles planned for conversion will be primarily operated in the South Coast Air Quality Management District (SCAQMD), with a small percentage of operation in peripheral AQMDs. Implementation of this technology as planned, will realize a significant and immediate environmental benefit in these districts.

Emissions Benefit

The Series 60 LNG engine offers a significant NOx benefit compared to current diesel engines. NOx emissions have been certified at a level of 1.95 grams per horsepower-hour for the 400 horsepower rating planned for the converted grocery fleet vehicles. Calculations based on EPA's methodology were provided in DDC's originally submitted SOW that yielded a NOx emissions benefit over the life-to-overhaul period for the thirty-two planned LNG conversions of 922.8 tons.

ARB requested that DDC explore the differences between grocery delivery fleet operational characteristics and Class 8 truck data available from EPA, and the consequent impact of these differences on calculated emissions benefits. DDC subsequently has obtained new information through further discussions with the participating grocery chains that has allowed re-estimation of NOx tonnage benefits. Attachment 1 details the revised NOx emissions benefit of 585.3 tons.

Offsetting factors included slower degradation in mileage as a function of age, and lower scrap rates.

ARB also requested that DDC provide information pertaining to relative merits of retrofitting older fleet vehicles with LNG engines and fuel systems as compared to converting new vehicles to LNG. DDC had provided feedback to ARB (see Attachment 2, letter dated June 5, 2000) and since that time, has conducted further discussions with the participating grocery companies during which additional information was brought forth supportive of new vehicle conversions rather than old vehicle retrofits.

- 1) Participating grocers have a strong interest in assessing operating costs, vehicle downtime, performance and other considerations relevant to the decision making process for future purchases of LNG fueled vehicles. It

is clear that retrofitting older vehicles with LNG engines and systems would unfavorably bias the comparison against LNG due to known increase in downtime of older vehicles, and higher fuel consumption arising from lower efficiencies of older technology vehicles.

- 2) A valid assessment of LNG technology for the application requires comparisons through a full life cycle. Such an objective could not be reached given that the need for decommissioning an older retrofitted vehicle would arise prior to normal life cycle mileage accumulation.
- 3) On the average, the grocer's fleet vehicles are approximately . Given that vehicles are planned to be decommissioned at , retrofit of an older vehicle only offers the opportunity for emissions reduction over less than half the mileage accumulation possible for a new converted vehicle. Again, downtime associated with older vehicles will diminish mileage accumulation and subsequent emissions benefits as compared to new vehicles.
- 4) Finally, the importance of driver satisfaction and its impact on driving behavior and related aspects of vehicle performance and reliability need to be recognized. In this regard, newly converted vehicles are significantly more favorable than older retrofitted vehicles.

Simply put, the interest on the part of grocers to pursue new vehicle conversions thus affording the best opportunity for LNG technology to compare favorably to diesel technology is in jeopardy should it be required that older vehicles be retrofitted. DDC plans to move forward in support of the grocer's motivation to establish conditions conducive to the highest probability of success for LNG demonstration.

In addition, ARB requested additional information pertaining to selection of fuel tank size, and operating range limitations of the LNG fueled vehicles. In the case of ' vehicle conversions, original diesel fuel tank capacity of gallons was specified, allowing mileage accumulation of 800+ miles before requiring refill. This equates to approximately two tank refills during a typical week's mileage accumulation. Conversion of diesel fuel to LNG includes installation of two tanks, each of which has a usable capacity of gallons LNG, yielding a usable range of about miles. The LNG fuel tanks, thus sized, assure no operational disadvantage against LNG vehicles relative to frequency of refueling. Installation of the large capacity LNG fuel tanks required specifying long wheelbase chassis for the vehicle builds.

Implementation

Detroit Diesel Corporation will coordinate and manage the conversion of a targeted thirty-two Class 8 grocery delivery trucks from diesel fuel operation to Liquid Natural Gas (LNG) operation. DDC will be responsible for providing all labor and material to support these conversions, within the limitations of this project. Vehicles will

be provided to DDC per a schedule that is mutually agreeable to the Air Resources Board, the participating customers, and DDC.

Valley Detroit Diesel Allison (VDDA) who is the DDC Authorized, franchised distributor in California, will execute the vehicle and engine conversions from diesel to LNG. The conversion of each engine and vehicle is planned to require two weeks of time, with the first (pilot) unit for each customer requiring four weeks in order to define and fabricate conversion components, complete drawings, and document the conversion process that will be followed during successive conversions. Once converted, the LNG Series 60 engine will be programmed with a rating of 400 horsepower and 1450 ft.-lbs. peak torque. This engine configuration and rating is certified to the California 2.5 gram per horsepower-hour NOx standard. After completion of the pilot installation and calibration checkout, the vehicle will be road tested as required to verify functionality and resolve any operational concerns prior to delivery to the customer.

Engine and Vehicle Conversion

VDDA will perform the conversion of both the engine and vehicle from diesel to LNG operation. All necessary components for the conversions will be provided by DDC.

Vehicle modifications will include removal of the existing diesel fuel tanks, filters, and fuel lines. VDDA will install fuel tanks, vaporizer, manual fuel shut-off valve, and natural gas filters. They will also fabricate and install LNG fuel and vent lines, install and provide wiring for fuel gages, and install control relays and associated wiring.

Conversion Schedule

DDC is currently working through scheduling logistics with two grocery companies, . that operate grocery delivery fleets in the SCAQMD and, to a lesser extent, surrounding districts. DDC's objective with each of the companies is to convert a total of sixteen vehicles prior to the end of 2001. While the build schedule from program start through the end of the first quarter of 2001 is established for each of the grocers, build schedules beyond that point depend on the operational success of vehicles commissioned in the first phase. Orders for long lead-time fuel system components have been placed for each fleet's first (pilot) vehicle conversion.

These trucks are equipped with an extended wheelbase chassis to accommodate LNG fuel

tanks having adequate range for the intended service. Truck builds have been accelerated ahead of the schedule outlined in the April 10, 2000 SOW submittal. The pilot truck is scheduled for conversion completion early in the fourth quarter of 2000. The first unit, or pilot, will take VDDA approximately 4 weeks to convert as they will engineer and document the conversion specifics, with on-site DDC support. VDDA will also dynamometer check the pilot truck and drive it as required to resolve any issues with vehicle operation. A series of five trucks are scheduled to follow with build completion by the end of 2000. All trucks are planned to be commissioned to the distribution center. Provided that customer expectations are met with the first six LNG conversions, the remaining nine ten conversions will be scheduled for completion by mid-2001.

. The first truck is planned for delivery to VDDA in time for conversion of the pilot vehicle to be completed by early fourth quarter 2000. Two additional conversions are scheduled for completion by the end of 2000, with four following in the first quarter of 2001. Assuming customer satisfaction with the performance of LNG vehicles through the first half of 2001, DDC targets completion of nine additional conversions in the last quarters of 2001. LNG vehicles are targeted to be commissioned to distribution centers.

Once the pilot vehicles and documentation are completed, DDC's resources will have the ability to support a build schedule more aggressive than that outlined above. However, the participating grocers require a period of evaluation after commissioning their first vehicles. Such an evaluation period allows for definition of and implementation of resolutions for any operational problems identified during the evaluation period. Scheduling an evaluation period prior to completion of all builds thus provides the best opportunity for customer satisfaction with LNG technology and success of the overall program.

Projected Build Schedule – Pending First-Phase Performance Results

Quarter		
2 nd 2000	Truck order (pilot)	Truck order (pilot)
3 rd 2000	Truck build	Truck build
4 th 2000	Pilot conversion + 5 additional units	Pilot conversion + 2 additional units
1 st 2001	1 conversion completed	4 conversions completed
2 nd 2001	9 conversions completed	
3 rd 2001		6 conversions completed
4 th 2001		3 conversions completed

Engineering Support

DDC will provide support at VDDA by factory Engineering personnel for the pilot conversion from each fleet.

inspect VDDA's conversion, provide direction to resolve any installation issues, and support qualification testing towards approval of the conversion. This will account for two one-week periods of travel.

DDC will provide training to each fleet regarding operation, maintenance and troubleshooting of the Series 60 Natural Gas Engine.

. The training schedule will be customer driven, but recommended by DDC to be completed in parallel with the first vehicle's availability at the customer's fleet site.

In addition to the support detailed above, it is planned that communications between VDDA and factory personnel, and between the customer fleet maintenance staffs and factory personnel will be maintained as required to support the progress of the project according to schedule.

DDC Training and Support

As described above, DDC will provide the necessary training at the individual fleets and technical support to issue the successful implementation of this project. The planned expense for this activity is as follows:

. It is proposed that as this project is implemented that actual cost will be compared to these estimates

Execution of this Scope of Work is dependent on agreements being reached with participants to provide the vehicles on schedule, and anticipates performance meeting or exceeding customer expectations. DDC is progressing with discussions with each of the candidate fleets to solidify schedules and plans. DDC would request authorization and agreement from the California Air Resources Board to move forward with the above

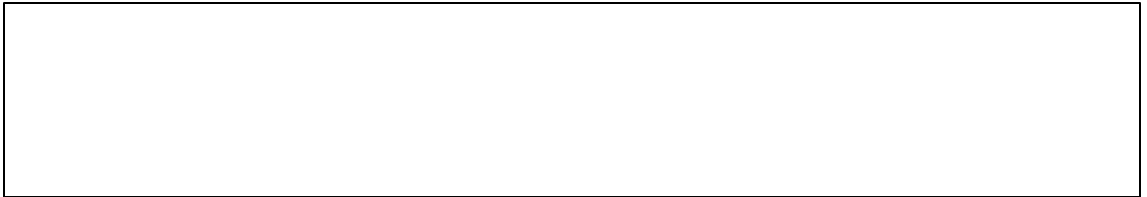
modified Scope of Work and finalize respective agreements as required with both grocery fleet customers.

DDC plans to begin pilot vehicle conversions upon availability of vehicles, which from information available to date, should be in August 2000. DDC will provide progress updates to ARB on a quarterly basis.

DDC submits this Scope of on our previous experience in supporting our customers needs and believes it satisfies the requirements of the Consent Decree and the California Settlement Agreement. If you have questions regarding our plan please feel free to contact DDC

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ATTACHMENT 1



The total NOx benefit from conversion of 32 vehicles to Series 60 LNG is:

$$556.2 + 29.1 = 585.3 \text{ tons}$$